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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/823,087	04/12/2004	Vincent K. Jones IV	021245-000310US	3166

20350 7590 08/07/2007

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EXAMINER
NGUYEN, TU X

ART UNIT	PAPER NUMBER
2618	

MAIL DATE	DELIVERY MODE
08/07/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/823,087	JONES ET AL.	
	Examiner	Art Unit	
	Tu X. Nguyen	2618	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 June 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17 and 19-74* is/are pending in the application.

4a) Of the above claim(s) *18* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,12-14,25-31 and 33-74* is/are rejected.

7)☒ Claim(s) *2-11,15-17,19-24 and 32* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 April 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 19-24 are objected to because of the following informalities: Claim 18 has been cancelled, and claims 19 lacks of antecedent dependent claim. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 37, 47 and 74 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter "smoothing the estimate channel" which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Response to Arguments

Applicant's arguments filed 6/27/07 have been fully considered but they are not persuasive.

Regarding claim 1, Applicants argue that Klimovitch fails to teach "adaptive truncation". The Examiner disagrees, Klimovitch discloses "frequency-domain channel response by

performing a second transform based-procedure on the truncated time-domain channel response" (par.013); wherein "transform" reads on "adaptively".

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1 and 13-14, are rejected under 35 U.S.C. 102(e) as being anticipated by Klimovitch (US Pub. 2002/0111142).

Regarding claim 1, Klimovitch discloses a method for determining channel estimates at a receiver for a wireless communication system using orthogonal frequency division multiplexing (OFDM) over a plurality of OFDM subcarriers, the method comprising:

receiving training signals from one or more receive antennas (see par.009);

computing an estimated channel impulse response from the received training signals by reference to a training sequence (see par.026-027); and

adaptively truncating the estimated channel impulse response in the time domain to improve the signal-to-noise ratio of the channel estimates (see par.013).

Regarding claim 14, Klimovitch discloses a method of channel estimation for a receiver of a multiple input, multiple output (MIMO) communication system wherein signals are

transmitted using orthogonal frequency division multiplexing (OFDM) over a plurality of OFDM subcarriers (see abstract), the method comprising:

receiving, at each of a plurality of receive antennas, training signals from a plurality of transmit antennas, wherein the signal from each transmit antenna includes a different subset of the plurality of OFDM subcarriers (see par.009);

transforming the received training signals at each receive antenna to a plurality of impulse coefficients for that receive antenna, each impulse coefficient corresponding to a different one of the OFDM subcarriers (see par.013); and

for each of the receive antennas, computing a channel impulse response for one of the transmit antennas using the impulse coefficients for the subset of the OFDM subcarriers transmitted by the one of the transmit antennas (see par.004).

Regarding claim 13, Klimovitch discloses the receiver includes a plurality of receive antennas and wherein the steps of receiving, computing, and adaptively truncating are performed for each of the receive antennas (see par.013).

Claims 25-26, 28, 35-36 and 69-70 are rejected under 35 U.S.C. 102(b) as being anticipated by Moose (US Pub. 2002/0065047).

Regarding claim 25, Moose discloses a method of tracking channel variations during receipt of a packet using one or more receive antennas, comprising:

determining an initial channel estimate from training data included in the packet (see par.009);

identifying a received symbol in the packet (see par.066), wherein the received symbol corresponds to an input symbol value that is not part of a training sequence (see par.024, guard interval, cyclic extension corresponds to not part of training sequence);

estimating an input symbol value using the received symbol value and the initial channel estimate (see par.067-0108);

deriving a per-symbol channel estimate from the received symbol value and the estimated input symbol value (see par.067-0108); and

updating the initial channel estimate using the per-symbol channel estimate (see par.039,043).

Regarding claim 26, Moose discloses updating the initial channel estimate includes applying a first order filter to the initial channel estimate and the per-symbol channel estimate (see par.021).

Regarding claim 28, Moose discloses the packet is transmitted using orthogonal frequency division multiplexing (OFDM) over a plurality of OFDM subcarriers and wherein channel variations are tracked for each of the OFDM subcarriers (see par.021).

Regarding claims 35-36 and 70, Moose discloses the signals comprise packets complying with IEEE 802.11a (see par.009).

Regarding claim 69, Moose discloses a method for transmitting, using a transmitter having at least one transmit antenna, training signals in a wireless communication system for use in determining channel estimates at a receiver for a wireless medium using orthogonal frequency division multiplexing (OFDM) over a plurality of OFDM subcarriers, the method comprising: transmitting, using the at least one transmit antenna, one or more training symbols

usable by a receiver to estimate a channel response over a legacy set of OFDM subcarriers; and transmitting, using the at least one transmit antenna, one or more additional training symbols usable for estimating channel response over an additional set of OFDM subcarriers (see abstract, par.008, 043).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 12, 30-31 and 33-34, are rejected under 35 U.S.C. 103(a) as being obvious over Klimovitch (US Pub. 2002/0111142) in view of Moose (US Pub. 2002/0065047).

Regarding claims 12, 30-31 and 33-34, Klimovitch fails to disclose the receiver is configured to receive packets complying with IEEE 802.11a.

Moose discloses the receiver is configured to receive packets complying with IEEE 802.11a (see par.009). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Klimovitch with the above teaching of Moose in order to provide a WLAN OFDM receiver as specified in the IEEE802.11a standard.

Claim 29 is rejected under 35 U.S.C. 102(e) as being anticipated by Klimovitch (US Pub. 2002/0111142) in view of Priotti (US Pub. 2004/0105512).

Regarding claim 29, Klimovitch fails to using a window filter in the time domain.

Priotti discloses using a window filter in the time domain. Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Klimovitch with the above teaching of Priotti order to provide synchronization instants using a wide/narrow selection window so that significantly reduces the probability of erroneous under low SNR reception conditions.

Claims 27 and 70, are rejected under 35 U.S.C. 103(a) as being obvious over Moose (US Pub. 2002/0065047) in view of Klimovitch (US Pub. 2002/0111142).

Regarding claim 27, Moose fails to disclose the packet is transmitted using a plurality of transmit antennas and received using a plurality of receive antennas, and wherein channel estimates are derived as a matrix for respective channels between each of the transmit antennas and each of the receive antennas.

In the related art, Klimovitch discloses the packet is transmitted using a plurality of transmit antennas and received using a plurality of receive antennas, and wherein channel estimates are derived as a matrix for respective channels between each of the transmit antennas and each of the receive antennas (see par.046). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Moose with the above teaching of Klimovitch in order to improving the bandwidth efficiency archived by estimating MIMO channel characteristics by transmitting sequences simultaneously from a plurality of transmitting antennas.

Regarding claims 70, Moose fails to disclose the number of transmit antennas is two or more and training signals transmitted over the legacy set of OFDM subcarriers are distinct over at least two of the transmit antennas.

Klimovitch discloses the number of transmit antennas is two or more and training signals transmitted over the legacy set of OFDM subcarriers are distinct over at least two of the transmit antennas.

Claims 37-46 are rejected under 35 U.S.C. 103(a) as being obvious over Moose (US Pub. 2002/0065047) in view of Maltsev et al. (US Pub. 2004/0120428).

Regarding claim 37, Moose disclose a method for determining channel estimates at a receiver for a wireless communication system using orthogonal frequency division multiplexing (OFDM) over a plurality of OFDM subcarriers, the method comprising: receiving training signals from one (see abstract "transmitter" corresponds to "antenna") or more receive antennas; computing an estimated channel response from the received training signals by reference to a training sequence (see par.067-0108).

Moose fails to disclose adaptively smoothing the estimated channel response in the frequency domain to improve a signal-to-noise ratio of the channel estimates.

Maltsev et al. disclose adaptively smoothing the estimated channel response in the frequency domain to improve a signal-to-noise ratio of the channel estimates (see par.025). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Moose with the above teaching of Maltsev in

order to provide a smoothing frequency domain block to improve the accuracy of the channel estimate.

Regarding claim 38, the modified Moose discloses updating the estimated channel response within a packet based on received data symbols of the packet (see Moose, fig.8, elements 813, 815).

Regarding claim 39, the modified Moose discloses after determining an initial channel estimate from the received training signals included in a packet, identifying a received OFDM data symbol in the packet (see Moose, par.024); estimating an input OFDM data symbol value using the received OFDM data symbol value and the initial channel estimate; deriving a per-OFDM symbol channel estimate from the received OFDM data symbol value and the estimated input OFDM data symbol value; and updating the initial channel estimate using the per-OFDM symbol channel estimate (see Moose, fig.8).

Regarding claim 40, the modified Moose discloses adaptively smoothing comprises truncating an estimated channel impulse response in the time domain and transforming the truncated channel impulse response estimate to the frequency domain (see Maltsev et al., par.023).

Regarding claim 41, the modified Moose discloses adaptively smoothing comprises filtering an estimated channel impulse response using a window filter in the time domain and transforming the filtered channel impulse response estimate to the frequency domain (see Maltsev et al., par.023).

Regarding claims 42 and 45, the modified Moose discloses the receiver is configured to receive packets complying with IEEE 802.11a (see Moose, par.009).

Regarding claims 43 and 46, the modified Moose discloses the receiver is configured to receive packets complying with IEEE 802.11 (see Moose, par.007).

Regarding claim 44, the modified Moose discloses adaptively smoothing the estimated channel response includes: computing a channel power function representing power received near a sample time; estimating channel noise; computing a cutoff time based on the channel power function and the estimated channel noise (see Maltsev et al., par.028); truncating the estimated channel impulse response in the time domain at the cutoff time; and transforming the truncated time domain channel impulse response estimate to a frequency domain channel estimate (see Maltsev et al., par.028).

Claims 47-57 are rejected under 35 U.S.C. 103(a) as being obvious over Klimovitch (US Pub. 2002/0111142) in view of Maltsev et al. (US Pub. 2004/0120428) and further in view of Stuber (US Pub. 2003/0076777).

Regarding claim 47, Klimovithch discloses a method of channel estimation for a receiver of a multiple input, multiple output (MIMO) communication system wherein signals are transmitted using orthogonal frequency division multiplexing (OFDM) over a plurality of OFDM subcarriers, the method comprising: receiving, at each of a plurality of receive antennas, training signals from a plurality of transmit antennas (see par.009),

transforming the received training signals at each receive antenna to a plurality of impulse coefficients for that receive antenna, wherein the plurality of impulse coefficients depend, at least in part, on the received MIMO preamble; and for each of the receive

antennas, computing a channel impulse response for one of the transmit antennas using the impulse coefficients (see par.009, 013),

Klimovithch fails to disclose computing a channel impulse response includes adaptively smoothing the channel impulse response in the frequency domain.

Maltsev et al. disclose computing a channel impulse response includes adaptively smoothing the channel impulse response in the frequency domain (see par.025). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Moose with the above teaching of Maltsev in order to provide a smotthing frequency domain block to improve the accuracy of the channel estimate.

Klimovithch fails to disclose the training signals comprise both an IEEE 802.11 a standard preamble and a MIMO preamble.

Stuber et al. discloses the training signals comprise both an IEEE 802.11 a standard preamble and a MIMO preamble (see par.008). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Klimovitch with the above teaching of Stuber et al. in order to maximize SNR.

Regarding claims 48-50, 52-57, the modified Klimovithch discloses the training signals are training symbols arranged such that a legacy receiver can interpret the IEEE 802.11 a standard preamble (see Stuber par.008).

Regarding claim 51, the modified Klimovithch fails to disclose the receiver receives the training signals from one of the transmit antennas while other transmit antennas are not transmitting. The Examiner takes an official notice that the concept diversity antennas which one of the transmit antennas while other transmit antennas are not transmitting is available at

the time of the invention was made that one or plurality of antennas transmit simultaneously for accuracy receiving high quality signal.

Claims 58-68 are rejected under 35 U.S.C. 103(a) as being obvious over Klimovitch (US Pub. 2002/0111142) in view of Stuber (US Pub. 2003/007677).

Regarding claim 58, Klimovithch discloses a method of channel estimation for a receiver of a multiple input, multiple output (MIMO) communication system wherein signals are transmitted using orthogonal frequency division multiplexing (OFDM) over a plurality of OFDM subcarriers, the method comprising: receiving, at each of a plurality of receive antennas, training signals from a plurality of transmit antennas (see par.009),

Klimovithch fails to disclose the training signals comprise both an IEEE 802.11 a standard preamble and a MIMO preamble.

Stuber et al. discloses the training signals comprise both an IEEE 802.11 a standard preamble and a MIMO preamble (see par.008). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Klimovitch with the above teaching of Stuber et al. in order to maximize SNR.

Regarding claim 59, the modified Klimovitch discloses the training signals are training symbols arranged such that a legacy receiver can interpret the IEEE 802.1 la standard preamble (see Stuber et al., par.008).

Regarding claims 60 and 63-68, the modified Klimovitch discloses the MIMO preamble is transmitted following in time after the conventional 802.11 a preamble (see Stuber et al., par.008).

Regarding claim 61, the modified Klimovitch the MIMO preamble is transmitted over all transmitters using all subcarriers that are used for data (see Stuber et al., par.008)

Regarding claim 62, the modified Klimovitch discloses at least one transmit period exists during which one transmit antenna transmits its training signals while all other transmit antennas do not transmit signals. The Examiner takes an official notice that the concept diversity antennas which one of the transmit antennas while other transmit antennas are not transmitting is available at the time of the invention was made that one or plurality of antennas transmit simultaneously for accuracy receiving high quality signal.

Claims 71-72, are rejected under 35 U.S.C. 103(a) as unpatentable over Moose .

Regarding claim 71, Moose fails to disclose the additional set of OFDM subcarriers comprises four subcarriers. The Examiner takes an official notice that four subcarriers in the OFDM MIMO mode is available at the time the invention was made.

Regarding claim 72, Klimovitch fails to disclose the training symbols transmitted over the legacy set of OFDM subcarriers are transmitted in a SIMO mode. The Examiner takes an official notice that four subcarriers in the OFDM SIMO mode is available at the time the invention was made.

Claim 73 is rejected under 35 U.S.C. 103(a) as unpatentable over Moose in view of Klimovitch (US Pub. 2002/0111142).

Regarding claim 73, Klimovitch discloses the number of transmit antennas is two or more and training signals transmitted over the legacy set of OFDM subcarriers are distinct over at least two of the transmit antennas (see par.009).

Claim 74 are rejected under 35 U.S.C. 103(a) as being obvious over Hudson (US Pub. 20030043887) in view of Maltsev et al. (US Pub. 2004/0120428).

Regarding claim 74, Hudson discloses a method for determining channel estimates at a receiver for a wireless communication system using orthogonal frequency division multiplexing (OFDM) over a plurality of OFDM subcarriers, the method comprising: receiving training signals from one or more receive antennas; computing an estimated channel impulse response from the received training signals by reference to a training sequence, wherein the training sequence for each transmit antenna is such that the training symbols sent from any two of the plurality of transmit antennas differ only in a cyclic shift and the receiver is configured to receive such signals (see par.0128-0129).

Hudson fails to disclose adaptively smoothing the estimated channel impulse response in the frequency domain.

Maltsev et al. disclose adaptively smoothing the estimated channel impulse response in the frequency domain (see par.025). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Hudson with the above teaching of Maltsev in order to provide a smoothing frequency domain block to improve the accuracy of the channel estimate.

Allowable Subject Matter

Claims 2-11, 15-17 and 19-24 and 32, objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance:

Claims 2, 5 and 15, would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed Tu Nguyen whose telephone number is 571-272-7883.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Urban, can be reached at (571) 272-7899. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

August 02, 2007